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spot, near which the planet passed, was decidedly less black than *Mercury*.

The instrument used was the $8\frac{1}{2}$-inch equatorial reflector, aperture reduced to 5 inches and provided with a Sun diagonal and achromatic eyepiece magnifying 96 diameters.

Paddington, Sydney, N.S.W.:
1894 *November* 14.

The Transit of Mercury, 1894 *November* 11; *Egress*. By J. P. Thomson, F.R.S.G.S., &c., President of the Royal Geographical Society of Australasia, Brisbane.

(*Communicated by the Secretaries.*)

The instrument used to observe the transit of *Mercury* was an equatorially mounted refracting telescope, 6 feet focal length, with object-glass 6 inches in diameter, built by Sir Howard Grubb in 1884. It is the property of Mr. F. D. G. Stanley, F.R.I.B.A. The telescope rests on a hollow cast-iron column, 5 feet 9 inches in height, and 18 inches diameter at the base, in which is placed the driving clock. The whole metal work is mounted on a stone and concrete foundation carried down to the solid rock 6 feet below the surface of the ground, perfect freedom from vibration being thereby secured.

The observatory, which is situated at "Ardincraig," Toowong, the private residence of Mr. Stanley, is a wooden building, 12 feet square, with roof arranged so as to roll entirely off on a railway and framing built to receive it. There can be no doubt whatever that, in a fine climate, this arrangement possesses many advantages to which I shall refer later on. Included in the equipment of the observatory is a transit instrument, by Carl Bamberg, of Berlin (1879). This is placed upon a stone pedestal. The observations are taken through the hollow central axis of the instrument, the eyepiece being fitted with micrometer. A magnifying power of 100 diameters was used in the equatorial for the actual observation of the transit, this having been found, after repeated tests, to give the most perfect definition. The object-glass of the telescope was stopped down to 3 inches.

The party consisted of his Excellency General Sir Henry Wylie Norman, Governor of Queensland, Messrs. F. D. G. Stanley, and Arthur Cleminson, of the Surveyor-General's Staff, time recorders, and myself, who observed the transit. There were three chronometers used, namely:—No. 542, mean time, by Frodsham, in charge of his Excellency the Governor; No. 2139, also mean time, by Arnold, in the hands of Mr. Stanley, and No. 4230, sidereal, by Kullberg, under the care of Mr. Cleminson. The first belongs to Mr. Stanley's observatory, but the others, one of which is the property of the Hon. A. C. Gregory, were

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duly compared with the standard clock at the Brisbane City observatory for several days previous, and late on Saturday night, immediately before Mr. Cleminson and I transported them to Toowong, the former gentleman finally checked them by meridian stars. After the transit had been observed the chronometers were at once returned to the City observatory and recompared. No. 4230 was found to have undergone no change whatever in transit, but there was a very slight displacement observed in the rate of the mean time chronometer. This recalls to my mind a similar experience at the time I was preparing to observe the transit of *Venus* at Levuka, Fiji, in 1882. On that occasion three chronometers were also rated, although only one, the best, was actually used to record the times of the observations. Some two weeks before the date of the transit they were transported with the greatest possible care for a very short distance from the Harbour Master's Office to the observatory, when it was found that a very slight change of rate had taken place.*

Weather.—Shortly after 5 o'clock the sun rose above a clear horizon free from the slightest trace of haze. The whole sky was cloudless, the weather nearly a dead calm, and the atmosphere almost phenomenally steady and agreeably warm. A few preceding days of fine clear dry weather had happily dissipated the moisture accumulated in the atmosphere during previous daily showers, and thus we were privileged to conduct the observations under the most favourable conditions, in every respect typical. After considerable experience in astronomical work, I can honestly state that in no climate have I ever conducted astronomical observations under more favourable atmospheric conditions than those prevailing at Brisbane on the morning of 1894 November 11. A fair idea of these may be conveyed by stating that from sunrise till shortly before the internal contact the planet appeared against the solar surface as a clear and sharply defined disc through a small portable telescope which Mr. Stanley had placed outside the observatory door, and Mr. C. B. Lethem, observing with a 5-inch theodolite at Clayfield, some six miles north-east of our position, was able to record the interval of time between internal and external contacts by an ordinary watch to within 17 seconds of the calculated interval. I have purposely emphasised this description of the weather, having long ago arrived at the conclusion that the so-called black drop and other somewhat remarkable phenomena associated with the observations of the transit of planets are due to terrestrial causes, and not celestial. In other words, they arise from unfavourable atmospheric conditions, from telescopic defect, or from some peculiarity in the physical condition of observers, either one or all combined. This subject has, I may state, been very ably elucidated by the distinguished astronomer Mr. H. C. Russell in

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* *Proceedings and Transactions of the Royal Geographical Society of Australasia. Queensland*, vol. vii. p. 93.

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a valuable paper upon the previous transit of *Mercury*, contributed to the Royal Society of New South Wales, 1881 December 7. My own experience entirely confirms the views advanced by Mr. Russell.

The Observations.—At 5 hours 10 minutes the equatorial was pointed to the Sun. The several small clusters of spots which had been observed on the solar surface for some few days previous were clearly visible as the Sun gradually cleared the neighbourhood of the horizon. There was no difficulty whatever in distinguishing the planet, for *Mercury* at once appeared in the field as a most perfect sphere, intensely black, with remarkably clear and sharply defined periphery. For some time I sat intently watching this interesting object as it slowly moved across the great solar surface. Particular attention was given to an examination of the effect of different magnifying powers and of various intensities of light by a manipulation of the combination of dark glasses used in the eyepiece of the telescope, but this produced no change whatever in the appearance of the planet. The definition was perfect, and there was not the slightest trace of haze, band of light, or vaporous aureola around the disc of *Mercury*. Attention was next bestowed upon a very minute white spot that appeared upon the surface of the planet. I was aware that a similar object had been noticed by several observers during previous transits, although I had failed to see anything of the kind at the transit of 1881, which I observed with a small telescope under distressing conditions. In this instance the steady, unchangeable appearance of the object left no doubt in my mind whatever that it was something more tangible than an optical illusion. I removed the lower magnifying power, and applied one of 450 diameters, and at first thought I saw two white spots close together, but after the eye had accommodated itself to the change the second spot assumed a very uncertain appearance, and for this reason I doubt its existence altogether; the first, however, remained unchanged. When about to observe internal contact, I was somewhat startled by what appeared, for the moment, to be a slight indication of ligament, but the phenomenon was only momentary, and I regard it as purely optical. When external contact occurred the limb of the Sun and that of the planet were remarkably clear, sharp, and well defined. There was not the slightest trace of disturbance in the limbs of the two bodies, and I have every confidence in recording the phase as a pure geometrical contact.

I very carefully watched for the planet when it separated from the Sun, but no trace of its periphery could be distinguished from the dark space beyond.

Taking the mean of the three chronometer records, the following are the corrected times of the observations, namely—

	h	m	s
Internal contact	7	23	42·45
Geometrical external contact ...	7	25	28·00

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The above are the mean times at Brisbane Observatory in latitude 27° 29′ 0″·2 S., and longitude $10^h\ 12^m\ 0^s$ E. We occupied a position of about 6534 feet south and 10,428 west of the Brisbane Observatory.

Regarding Mr. Stanley's observatory it will probably be found in general practice that a telescope is capable of doing better work when placed within a building with the roof entirely off than in one enclosed by the common revolving circular dome. In the former the air currents are more likely to be nearly uniform in temperature, while in the latter type, opposing currents of air of unequal temperature are apt to materially influence definition. It is not, I believe, an extremely high nor abnormally low temperature an observer need fear, but unsteady and constantly changing air currents, within the observatory as well as without, that are inimical to good telescopic work. Once modify or minimise these conflicting elements, maintain uniformity of temperature in the observatory, and the results of astronomical observations will probably rise 50 per cent. nearer the truth than at present.

In conclusion I have great pleasure in acknowledging the efficient aid rendered by the three gentlemen with whom I was associated in this work, and of testifying to the satisfactory degree of accuracy of the times recorded by them.

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Observations of Encke's Comet made at the Royal Observatory, Greenwich.

(*Communicated by the Astronomer Royal.*)

The observations were made with the East, or Sheepshanks, Equatorial, aperture 6·7 inches, by taking transits over two cross-wires at right angles to each other, and each inclined 45° to the parallel of declination. Magnifying power, 55.

Greenwich Mean Solar Time.	Observer.	☄ − ✱ R.A.	Corr. for Refraction.	Corr. for Parallax.	☄ − ✱ N.P.D.	Corr. for Refraction.	Corr. for Parallax.	No. of Comps.	Apparent R.A. of ☄.	Apparent N.P.D. of ☄.	Comp. ✱
1895. d h m s		m s	s	s	′ ″	″	″		h m s	° ′ ″	
Jan. 13 5 33 2	B.	−2 10·14	−0·03	+0·35	+12 50·9	+0·4	− 9·4	2	22 5 12·93	89 32 44·9	*a*
13 5 43 29	,,	−3 15·03	+0·01	+0·37	− 5 31·3	−0·2	− 9·4	4	22 5 12·43	89 32 54·7	*b*
14 6 12 21	H. F.	+3 33·65	0·00	+0·42	+ 1 25·7	+0·1	− 9·5	8	22 3 43·23	89 54 18·1	*c*
14 6 12 21	,,	+1 59·92	+0·01	+0·42	− 2 16·1	−0·1	− 9·5	8	22 3 43·17	89 54 16·0	*d*
16 6 38 7	B.	−0 7·24	+0·04	+0·48	− 7 10·0	−0·6	− 9·8	1	22 0 15·89	90 42 33·8	*e*
17 6 33 24	H.	−1 12·17	+0·09	+0·48	−14 10·9	−0·7	−10·0	3	21 58 10·97	91 10 35·7	*f*
17 6 33 24	,,	−1 39·23	+0·01	+0·48	− 1 50·6	0·0	−10·0	3	...	...	*g*
18 5 52 40	B.	−0 23·19	−0·01	+0·45	+ 2 24·1	+0·2	−10·2	3	21 55 57·20	91 40 21·0	*h*
18 5 56 43	H. F.	−0 23·65	−0·01	+0·46	+ 2 27·7	+0·2	−10·2	3	21 55 56·75	91 40 24·6	*h*
18 6 21 4	A. C.	−0 26·02	−0·02	+0·49	+ 3 6·0	+0·4	−10·2	2	21 55 54·40	91 41 3·1	*h*
23 5 41 49	,,	+1 3·11	+0·07	+0·52	− 7 40·1	−0·6	−11·1	3	21 39 57·27	95 5 0·6	*i*
23 5 47 39	,,	−1 58·20	0·00	+0·52	− 0 24·2	0·0	−11·0	3	21 39 56·69	95 5 12·2	*k*

Notes.

The observations are corrected for refraction and parallax. In computing the latter log Δ has been taken from Dr. Backlund's ephemeris (*Ast. Nach.*, 3263), the values used being 9·8652, 9·8594, 9·8476, 9·8417, 9·8356, and 9·8068 on January 13, 14, 16, 17, 18, and 23 respectively. The observations are also corrected for the error of inclination of the wires, and for the motion of the comet. The apparent errors of Dr. Backlund's ephemeris in R.A. and N.P.D. (Tabular − Observed) are −2^s·91, +17″·2 from star *a*; −3^s·00, +16″·0 from star *b*; −2^s·22, +13″·5 from star *c*; −2^s·16, +15″·6 from star *d*; −5^s·00, +41″·4 from star *e*; −3^s·39, +24″·5 from star *f*; −4^s·01, +24″·1 from star *h* (B.); −3^s·96, +25″·9 from star *h* (H. F.); −4^s·05, +19″·5 from star *h* (A. C.); −5^s·84, +35″·2 from star *i*; −6^s·24, +35″·8 from star *k*.

January 13.—Cloudy; comet very bright. January 14.—Comet faint; cloudy. January 16.—Very cloudy; observation rough. January 23.—Comet visible in fairly bright twilight.

The initials H., A. C., B., and H. F. are those of Mr. Hollis, Mr. Crommelin, Mr. Bryant, and Mr. Furner respectively.